



FERMT1 gene

fermitin family member 1

Normal Function

The *FERMT1* gene provides instructions for making a protein called kindlin-1. This protein is found in epithelial cells, which are the cells that line the surfaces and cavities of the body. In the skin, kindlin-1 plays a critical role in specialized cells called keratinocytes, which are the major component of the outer layer of the skin (the epidermis).

Kindlin-1 is part of cell structures called focal adhesions. These structures contain many different kinds of proteins, which are involved in linking the cell's internal framework (the cytoskeleton) to the intricate lattice of proteins and other molecules that surrounds cells (the extracellular matrix). This linking is known as cell-matrix adhesion. Kindlin-1 attaches (binds) to and turns on (activates) proteins called integrins, which directly connect the cytoskeleton with the extracellular matrix and help transmit chemical signals into the cell.

As part of focal adhesions, Kindlin-1 is involved in several important cell functions, including cell growth and division (proliferation) and the movement (migration) of cells.

Health Conditions Related to Genetic Changes

Kindler syndrome

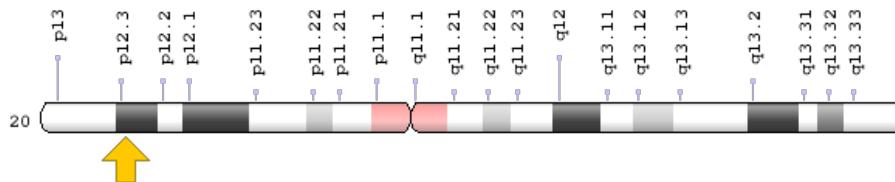
More than 70 mutations in the *FERMT1* gene have been identified in people with Kindler syndrome. This disorder is a rare type of epidermolysis bullosa, which is a group of genetic conditions that cause the skin to be very fragile and to blister easily. Kindler syndrome also affects the moist lining (mucosae) of the mouth, eyes, esophagus, intestines, genitals, and urinary system, causing these tissues to be very fragile. In addition, people with Kindler syndrome have an increased risk of developing a form of cancer called squamous cell carcinoma.

Most mutations in the *FERMT1* gene prevent the production of any functional kindlin-1. A lack of this protein disrupts many essential cell functions. For example, keratinocytes without kindlin-1 have an abnormal structure and cannot grow or divide normally. They are also less able to attach the epidermis to the underlying layer of skin (the dermis). These changes make the skin fragile and prone to blistering. Similarly, a lack of kindlin-1 in epithelial cells of the mucosae causes damage that makes these tissues extremely fragile. It is unclear how a shortage of kindlin-1 is related to squamous cell carcinoma in people with Kindler syndrome.

Chromosomal Location

Cytogenetic Location: 20p12.3, which is the short (p) arm of chromosome 20 at position 12.3

Molecular Location: base pairs 6,074,845 to 6,123,544 on chromosome 20 (Homo sapiens Annotation Release 108, GRCh38.p7) (NCBI)



Credit: Genome Decoration Page/NCBI

Other Names for This Gene

- C20orf42
- DTGCU2
- fermitin family homolog 1
- FLJ20116
- KIND1
- kindlerin
- kindlin 1
- kindlin syndrome protein
- unc-112-related protein 1
- UNC112 related protein 1
- UNC112A
- URP1

Additional Information & Resources

Educational Resources

- Molecular Biology of the Cell (fourth edition, 2002): Integrins
<https://www.ncbi.nlm.nih.gov/books/NBK26867/>
- Molecular Cell Biology (fourth edition, 2000): Cell-Matrix Adhesion
<https://www.ncbi.nlm.nih.gov/books/NBK21539/>

Scientific Articles on PubMed

- PubMed
<https://www.ncbi.nlm.nih.gov/pubmed?term=%28%28FERMT1%5BTIAB%5D%29+OR+%28fermitin+family+member+1%5BTIAB%5D%29%29+OR+%28%28KIND1%5BTIAB%5D%29+OR+%28kindlerin%5BTIAB%5D%29+OR+%28kindlin+1%5BTIAB%5D%29%29+AND+english%5Bla%5D+AND+human%5Bmh%5D+AND+%22last+1800+days%22%5Bdp%5D>

OMIM

- FERMITIN FAMILY (DROSOPHILA) HOMOLOG 1
<http://omim.org/entry/607900>

Research Resources

- Atlas of Genetics and Cytogenetics in Oncology and Haematology
http://atlasgeneticsoncology.org/Genes/GC_FERMT1.html
- ClinVar
<https://www.ncbi.nlm.nih.gov/clinvar?term=FERMT1%5Bgene%5D>
- HGNC Gene Family: FERM domain containing
<http://www.genenames.org/cgi-bin/genefamilies/set/1293>
- HGNC Gene Family: Fermitins
<http://www.genenames.org/cgi-bin/genefamilies/set/561>
- HGNC Gene Family: Pleckstrin homology domain containing
<http://www.genenames.org/cgi-bin/genefamilies/set/682>
- HGNC Gene Symbol Report
http://www.genenames.org/cgi-bin/gene_symbol_report?q=data/hgnc_data.php&hgnc_id=15889
- NCBI Gene
<https://www.ncbi.nlm.nih.gov/gene/55612>
- UniProt
<http://www.uniprot.org/uniprot/Q9BQL6>

Sources for This Summary

- Ashton GH, McLean WH, South AP, Oyama N, Smith FJ, Al-Suwaid R, Al-Ismaily A, Atherton DJ, Harwood CA, Leigh IM, Moss C, Didona B, Zambruno G, Patrizi A, Eady RA, McGrath JA. Recurrent mutations in kindlin-1, a novel keratinocyte focal contact protein, in the autosomal recessive skin fragility and photosensitivity disorder, Kindler syndrome. *J Invest Dermatol.* 2004 Jan;122(1):78-83.
Citation on PubMed: <https://www.ncbi.nlm.nih.gov/pubmed/14962093>
- OMIM: FERMITIN FAMILY (DROSOPHILA) HOMOLOG 1
<http://omim.org/entry/607900>

- Has C, Castiglia D, del Rio M, Diez MG, Piccinni E, Kirtsis D, Kohlhase J, Itin P, Martin L, Fischer J, Zambruno G, Bruckner-Tuderman L. Kindler syndrome: extension of FERMT1 mutational spectrum and natural history. *Hum Mutat.* 2011 Nov;32(11):1204-12. doi: 10.1002/humu.21576. Epub 2011 Sep 20. Review.
Citation on PubMed: <https://www.ncbi.nlm.nih.gov/pubmed/21936020>
- Heinemann A, He Y, Zimina E, Boerries M, Busch H, Chmel N, Kurz T, Bruckner-Tuderman L, Has C. Induction of phenotype modifying cytokines by FERMT1 mutations. *Hum Mutat.* 2011 Apr;32(4):397-406. doi: 10.1002/humu.21449. Epub 2011 Mar 1.
Citation on PubMed: <https://www.ncbi.nlm.nih.gov/pubmed/21309038>
- Herz C, Aumailley M, Schulte C, Schlötzer-Schrehardt U, Bruckner-Tuderman L, Has C. Kindlin-1 is a phosphoprotein involved in regulation of polarity, proliferation, and motility of epidermal keratinocytes. *J Biol Chem.* 2006 Nov 24;281(47):36082-90. Epub 2006 Oct 1.
Citation on PubMed: <https://www.ncbi.nlm.nih.gov/pubmed/17012746>
- Jobard F, Bouadjar B, Caux F, Hadj-Rabia S, Has C, Matsuda F, Weissenbach J, Lathrop M, Prud'homme JF, Fischer J. Identification of mutations in a new gene encoding a FERM family protein with a pleckstrin homology domain in Kindler syndrome. *Hum Mol Genet.* 2003 Apr 15;12(8):925-35.
Citation on PubMed: <https://www.ncbi.nlm.nih.gov/pubmed/12668616>
- Lai-Cheong JE, McGrath JA. Kindler syndrome. *Dermatol Clin.* 2010 Jan;28(1):119-24. doi: 10.1016/j.det.2009.10.013. Review.
Citation on PubMed: <https://www.ncbi.nlm.nih.gov/pubmed/19945624>
- Margadant C, Kreft M, Zambruno G, Sonnenberg A. Kindlin-1 regulates integrin dynamics and adhesion turnover. *PLoS One.* 2013 Jun 11;8(6):e65341. doi: 10.1371/journal.pone.0065341. Print 2013.
Citation on PubMed: <https://www.ncbi.nlm.nih.gov/pubmed/23776470>
Free article on PubMed Central: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3679067/>
- Siegel DH, Ashton GH, Penagos HG, Lee JV, Feiler HS, Wilhelmsen KC, South AP, Smith FJ, Prescott AR, Wessagowit V, Oyama N, Akiyama M, Al Aboud D, Al Aboud K, Al Githami A, Al Hawsawi K, Al Ismaily A, Al-Suwaid R, Atherton DJ, Caputo R, Fine JD, Frieden IJ, Fuchs E, Haber RM, Harada T, Kitajima Y, Mallory SB, Ogawa H, Sahin S, Shimizu H, Suga Y, Tadini G, Tsuchiya K, Wiebe CB, Wojnarowska F, Zaghloul AB, Hamada T, Mallipeddi R, Eady RA, McLean WH, McGrath JA, Epstein EH. Loss of kindlin-1, a human homolog of the *Caenorhabditis elegans* actin-extracellular-matrix linker protein UNC-112, causes Kindler syndrome. *Am J Hum Genet.* 2003 Jul; 73(1):174-87. Epub 2003 Jun 3.
Citation on PubMed: <https://www.ncbi.nlm.nih.gov/pubmed/12789646>
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